Why Katz is wrong: a lab-created creature can still have an ancient evolutionary history

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Katz denies that organisms created in a lab as part of a de-extinction attempt will be authentic members of the extinct species, on the basis that they will lack the original species' defining biological and evolutionary history. Against Katz, I note that an evolutionary lineage is conferred on an organism through its inheriting genes from forebears already possessed of such a lineage, and that de-extinction amounts to a delayed, human-assisted reproductive process, in which genes are inherited from forebears long dead. My conclusion is that de-extinct organisms can perfectly well have an ancient evolutionary history, contrary to what Katz claims.

Keywords: de-extinction, authenticity, evolution, species

De-extinction: saviour or false prophet?

Large trees take centuries to grow. Felled forests take millennia to regenerate. Hence it is the lot of the environmentalist to plan and think in very lengthy time scales. I believe an action we can perform relatively easily and cheaply now that would enable a precious component of the Earth's biodiversity to be preserved over such multi-century timescales is to cryogenically store diverse samples of biological material drawn from the many ecosystems around the world set to be lost in coming years as climate change ramps up in earnest. If humanity survives the Anthropocene then our descendants, centuries hence, will likely have biotechnology astronomically more advanced, and less expensive to wield, than ours. They will curse us for annihilating so much of the Earth's riotous natural wonder. But they will be eternally grateful for any 'frozen arks' we might have had the foresight to leave them—arks that can be mined for information and

DNA, enabling some fraction of the extinctions we have wrought to be undone (Clarke, 2009).

If de-extinction can contribute significantly to biodiversity conservation over the long term, then, I believe, this is why.

Eric Katz, however, would beg to differ. On his view, expressed in the target article, extinction is forever, and no future biotechnology, however powerful, could enable, say, an authentic golden toad to hop out of a biotech lab back into the restored cloud forests of Costa Rica.

In what follows I will outline why Katz thinks this, then explain why, on my view, his argument is specious. My conclusion, if correct, is important. Creating frozen arks should be a top priority.

Katz's argument

Can a team of landscape designers with bulldozers restore the lost value of a destroyed natural ecosystem by putting things back where they were? As famously observed by Robert Elliot (1982), the answer appears to be 'no'. Elliot's argument is summarizable thus:

E1. The value of a natural ecosystem inheres, largely, in its natural (usually, ancient) mode of origin.

E2. A restored substitute for a destroyed natural ecosystem will have an artificial, rather than natural, mode of origin.

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E3. A restored substitute for a destroyed natural ecosystem will lack the value of the original. (It will amount, in effect, to a kind of art forgery.)

Katz's argument against de-extinction precisely mirrors Elliot's argument against ecological restoration (and explicitly so). The following is, I believe, a fair reconstruction:

K1. The value of a natural organism inheres, largely, in its natural, ancient, evolutionary origins.

K2. A lab-created copy of an extinct natural organism will lack the natural, ancient, evolutionary origins of the original.

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K3. A lab-created copy of an extinct natural organism will lack the value of the original. (Like an artificially restored ecosystem, it will be no better than a kind of art forgery.)[1]

Katz's mistake

The analogy Katz relies on is faulty (Campbell, 2016, pp. 257–258, 2017; Campbell & Whittle, 2017, pp. 54–64). Whereas a natural ecosystem, like a wetland, may be very ancient, the organisms that inhabit it are not. Organisms are unlike ecosystems in that they reproduce, then die, to be replaced (all going well) by their offspring. This raises a puzzle: how can an organism, freshly born, say, just two minutes ago, already have, latent in it, an ancient evolutionary history? The answer, as we all know from Darwin, is that it possesses such a history in consequence of its lying at the end of a phylogenetic lineage stretching back aeons. Its inheriting an evolutionary history from its forebears is inseparable from its inheriting its genotype and phenotype from them.

[1] Others who have argued similarly to Katz include (Gunn, 1991) and (Minteer, 2015).

With this in mind, imagine that, tragically, the snow leopard goes extinct, but that, hundreds of years hence, synthetic biologists use genetic and epigenetic information extracted from the cryo-preserved cells of both a female and a male snow leopard, F and M, to create an organism, B, with copies of both F and M's genes, and that (success!) B has the phenotype of a perfectly normal baby snow leopard.[2]

B has a thick furry coat. Why? Well because B's genes are copied from F and M, which were in turn copied from the genes of their forebears, who inhabited a frigid environment where thick furry coats conferred a selective advantage. Thus, despite B's having been created in a lab, it may perfectly well be seen as a new addition to an ancient lineage. Its form and function, its genotype and phenotype, owe to natural selection operating on this lineage in the distant past.

Katz's error is not to see that what goes for ecosystems doesn't go for organisms. Yes, an artificial copy of an ecosystem lacks the natural history of the original, and it is to this extent less valuable than the original. But in contrast, a lab-grown organism that has been made by copying genes and their associated phenotypes from precursor organisms with an evolutionary history will inherit the evolutionary history of those precursor organisms, because such a history is transmitted, *even in normal, natural cases*, through the copying of genes and their associated phenotypes

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[2] I here suppose that B's genes come from one male and one female 'donor' in order to maximize similarity to natural reproduction, and so forestall a potential objection. However, my view is that this detail is in fact unimportant. B would—I say—still have an evolutionary history even if its genes were copied from, say, just one animal (of which B would be a clone), or pieced together from the genes of multiple animals.

from generation to generation. This is why, although Elliot's premise, E2, is plausible, Katz's K2 is not.

Possible counterarguments

Might Katz reasonably deny that de-extinct organisms have an evolutionary history, the above point notwithstanding? No. The plain fact is that on the standard, neo-Darwinian analysis (Griffiths, 1993), if B is the product of a sufficiently high-fidelity, counterfactual supporting copying process, then it *does* have such a history, inherited from F and M. It matters not one whit that F and M are now long dead, or that B was made in a lab.

Might he hold that this history, although extant, is somehow contaminated and devalued by the involvement of human *design* in the copying process? No, because, at least insofar as the synthetic biologists are merely faithfully creating new organisms according to the genetic and epigenetic blueprints extracted from the remains of long-dead organisms, no element of human design is present (any more than I can be said to have 'designed' my house by slavishly copying a second house).

Might he hold that B's evolutionary history, although extant, is devalued by the involvement of human intentionality and technology within the copying process? He might. But then he would owe us a reason as to why human involvement precipitates such a loss of value. The main reason he offers in the target paper is that human-assisted reproduction cannot yield an organism with an evolutionary history, but, as just explained, here he is mistaken. Nor does it appear likely he will be able to find any other adequate reason to put in its place. After all, human intentionality and technology are heavily involved the world over in biodiversity conservation efforts, and the plain fact is that people value species saved by intentionality-ridden human management every bit as much as much as species that have survived without such assistance. For

example, New Zealanders love the *takahē* just as much as the *pūkeko*, notwithstanding all the heavy-handed conservation interventions that saved the former. The 'values' Katz speaks of are his own, and, thankfully, not those of the conservation-minded public.

Conclusion

There is much at stake here. Katz would tie our hands when human intervention is required in order to save precious, beautiful, ancient biodiversity. His conservationist ethic is a form of nihilistic ecological puritanism, that makes the perfect the enemy of the good. I worry that with friends like this, the planet hardly needs enemies.

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